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EYESIGHT AND PAPER GLARE

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The attention of teachers has in recent years been directed vigorously to the hygienic problems of the schoolroom. We know something about the necessity of providing adequate ventilation. We have standard measures of the amount of window space that must be provided per unit of floor space. We have had studies of temperature and of proper adjustments of furniture. Special studies have also been made of such problems as the periods of various kinds of work which are possible without undue fatigue. These studies have been carried in the field of reading to the point of determining the size of type which will save the pupil from eye fatigue or undue strain. The following material collected from a number of sources is intended to keep before the minds of teachers and school officers the general principle that all of the equipment of the classroom affects the hygienic conditions under which pupils study. The teacher is likely to think of the style of paper used in a textbook as a matter of very minor importance. The following statements will help to correct this view.

In the *Electrical World* of March 21, 1914, Professor L. R. Ingersoll has an illustrated article, "A Means to Measure the Glaze of Paper." The instrument by which measurements are made is called the glarimeter, designed and constructed at the Forest Products Laboratory, United States Department of Agriculture at Madison, Wisconsin. Glare from paper, that is, the brilliant reflected light which induces contraction of the pupil, causes a loss of visual acuity and the resultant eyestrain. The glarimeter measures the glare; the percentage of glare determines the fitness or unfitness of paper for use in books.

> A paper which shows a 50 per cent glaze reading will give less glare than one of 60 per cent and, other things being equal, will be easier on the eye than the latter. The instrument will permit the printer to order a book paper

of less than, say, 40 per cent glare and will enable the paper-maker to meet this requirement with certainty.

A table of measurements gives percentages of glare varying from 15.1 for certain papers to 90.5 for others. The tests with unsized newspaper, uncalendered, showed 27.7 per cent glare. This same unsized newspaper, passed through the calendering rolls, gave glare percentages that increased from 33.3 for one passing to 64.8 for twenty-nine times passing or twenty-nine pinches.

Black and colored papers give higher glare readings than do white papers of same finish. Brown solio paper gives 99.2 per cent glare.

Dr. Ludwig Kotelmann has stated that, aside from seating and lighting questions in schoolrooms, "the first question to be considered in connection with the subject [of myopia in school children] is that of the preparation of hygienic schoolbooks. The paper used in them should be of a uniform yellowish white, since pure white is apt to prove dazzling, and must not be very glossy. It should contain as little wood pulp as possible and have an adequate thickness."

In *Hygiène oculaire des écoles*, Truc says:

> Papers very white, bluish, gray, or glazed should be rejected, because of reflections or insufficient legibility.

The Committee on Children's Welfare of the Association of Women Principals of Public Schools, New York City, held in 1908 a conference with an advisory board of oculists for the purpose of considering "The Remediable Causes of Eyestrain in Present Conditions," This conference unanimously adopted the suggestion "that hereafter no calendered or coated paper be permitted in the textbooks given to the children, as the dazzle of such paper is injurious to their eyes." In presenting this report to the Board of Education, the Committee on the Course of Study stated that "only 5 per cent of all cases of myopia are believed to be due to unpreventable and uncontrollable causes, and a great majority of cases of myopia are more or less directly traceable to eye strain in school. . . . The second assignable cause for the development of myopia is the kind of paper used in school books." Further, "it remains to be settled to what extent, if to any, machine-finished paper is harmful. . . . This latter question cannot be settled by educators, publishers, or printers, but should be determined by oculists. The latter, however, have never made an extended investigation of the subject, and hence can give only expert opinion which is not based on evidence. An investigation should determine the exact extent to which coated paper is used, the effects of such paper on the eyes of the pupils, the amount of time spent by pupils working continuously at books made of such paper, and how often a day they do so."

In the American School Hygiene Association's *Report on the Standardization of School Books*, 1911, all that the committee says on the subject of the paper of textbooks is, "The paper should be unglazed, free from shine and opaque," that textbooks "should be printed on a good quality of the modern light paper," that "at the present time there is no satisfactory consensus in regard to the question whether the paper of schoolbooks should be smooth or somewhat rough," and makes the suggestion that tests should be made to see whether "a certain degree of roughness will reduce the glare which to some extent is inevitable with clear white paper." As to whether schoolbook paper should be white or slightly tinted, the report states that "experimental evidence seems to indicate that black on white is more legible than on tinted paper, while clinical experience seems to point to the advantage of a slight tint."

In an address before this same Association in 1912, Van Rensselaer Lansingh, president of the Illuminating Engineering Society, stated as an axiom:

> All material used in classroom exercises, such as books, colored drawings, etc., should be printed on unglazed stock, i.e., the paper should have a mat surface which gives good diffuse reflection.

Barbara E. Roethlein, of Clark University, in her paper on *The Relative Legibility of Different Faces of Printing Types*, 1912, says:

> The quality and the texture of the paper is a much less significant factor than has been supposed, provided, of course, that the illumination and the inclination of the paper are such as to secure an optimal condition of light reflection from its surface.

The conclusion of the Oculist Subcommittee of the British Association for the Advancement of Science, in their recent report, is that some of the serious visual defect among school children is due to the books they use. Among specific recommendations are paper, unglazed but hard, smooth, and opaque, preferably white or cream-colored, uncalendered; "the most vital of all considerations with regard to paper is that it should be non-shiny."

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